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On the added-mass effects of mean compressible and incompressible flows in fluid-solid interaction R. JAIMAN, National University of Singapore, M. PARMAR, University of Florida, PARDHA SARADHI, National University of Singapore — The unsteady fluid-structure interaction (FSI) is of fundamental interest in its own right. It is also of practical interest in a wide range of natural phenomena and industrial applications. Understanding the effects of flexible wall and estimates of added-mass forces can provide insights to coupled fluid-structure dynamics as well the improvements of numerical algorithms and closed-form empirical relations. Starting from the seminal work of Kramer (M.O. Kramer. Readers Forum, J. Aerospace Sci., 27(68), 1960.) numerous work have been published describing experiments, theoretical analysis and computations to understand how flexible elastic walls affect hydrodynamic stability. Most of the prior analysis focused on inviscid incompressible flow interacting with an elastic flat plate. In this work we present further theoretical investigation of the added-mass effect and the instability of an elastic plate as well as a string under a variety of uniform mean flows consisting of incompressible and compressible, inviscid and viscous conditions. We discuss the influence of viscosity and compressibility on the instability modes of fluid-solid interaction. We note that the added-mass effect for incompressible flow has a global character and for compressible flow it is time dependent.

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